UNITED STATES PATENT APPLICATION

FOR

SERVER PACKAGING ARCHITECTURE UTILIZING A BLIND DOCKING PROCESSOR-TO-MIDPLANE MECHANISM

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SERVER PACKAGING ARCHITECTURE UTILIZING A BLIND DOCKING PROCESSOR-TO-MIDPLANE MECHANISM

FIELD OF THE INVENTION

The present invention relates to server packaging architectures, and more particularly to a dual motion mechanism for blind docking (printed circuit boards). Specifically for blind docking a processor board assembly to an orthogonally-oriented vertical midplane component board within a server chassis.

BACKGROUND OF THE INVENTION

Servers are designed today with a chassis that includes many electrical components and discrete functionality cards. For example, a server may comprise discrete functionality boards including, but not limited to those such as, an I/O card, a PCI subsection, a main central processor board, media devices, hard disk storage devices, and a service processor card. The components and cards are electrically connected to a component board, such as a component board, through high-speed connectors, such as, but not limited to connector

styles such as (HDM or VHDM). The function of the component board is to distribute power and to connect the various components and cards together.

Conventionally, the component board is mounted vertically inside the chassis, while the central processor board and the PCI subsection lie flat or horizontal and connect to the component board at right angles. There are generally two methods for implementing a vertical component board architecture. The first utilizes a component board mounted laterally in the chassis either (i.e., side-to-side). In this architecture, the central processor board is installed in a single motion by sliding the board into the chassis towards the component board until their connectors engage.

The second method for implementing a vertical component board architecture utilizes a component board mounted in the chassis in a front-to-rear orientation. In this architecture, several central processor boards may be installed in the chassis on one side of the component board, in which case the boards occupy all of the vertical space in the chassis on that side of the component board.

In some applications, however, only one central processor board is required, leaving space available in the chassis above the board. In this configuration, the thermal subsystem and even the power subsystem may be located in the chassis directly above the central processor board. In this case,

the central processor board cannot be installed from the top of the chassis, and must instead be installed from the front.

However, because the component board is mounted in the chassis parallel to the direction of installation of the processor board, a bi-directional docking mechanism is required to insert the central processor board into the chassis from front-to-rear, and to then laterally dock the board to the component board. The present invention addresses such a need.

SUMMARY OF THE INVENTION

A dual motion docking apparatus for docking an electronics console to a component board in a chassis is disclosed. The electronics console and the component board lie in the same plane of the chassis, but the electronics console must be mated with the component board at an angle orthogonal to a direction of installation of the electronics console. Aspects of the present invention include a first docking mechanism for slidably inserting the electronics console into a chassis, such that connectors on the electronics console align with connectors on the component board; and a second docking mechanism for laterally moving the electronics console towards the component board, such that the electronics console connectors engage the component board connectors, thereby enabling the blind docking between the electronics console and the component board.

According to the apparatus and method of the present invention, an operator can easily install or remove the electronics console from the front/rear of the chassis without having to remove other components even though the electronics console is mated with the component board at a ninety-degree angle.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a diagram illustrating a server system architecture incorporating a bi-directional docking mechanism in accordance with a preferred embodiment of the present invention.

FIG. 2 is a diagram illustrating a Central Electronics Console (CEC).

FIGS. 3A-3B are diagrams showing the CEC without a cover.

FIG. 4 is a diagram showing a cut-away view of the CEC docked with the component board.

FIGS. 5A and 5B are diagrams illustrating components of the dual motion docking mechanism that enable the first docking motion.

FIG. 6 is a diagram illustrating the base plate and the docking base when the CEC is in the docked position.

FIGS. 7A and 7B are views in which the docking base can be seen attached to the bottom of the component board.

FIGS. 8-11 are diagrams illustrating components of the dual motion docking mechanism that enable the second docking motion.

DETAILED DESCRIPTION OF THE INVENTION

The present invention relates to mechanical docking mechanisms for electronic boards. The following description is presented to enable one of ordinary skill in the art to make and use the invention and is provided in the context of a patent application and its requirements. Various modifications to the preferred embodiments and the generic principles and features described herein will be readily apparent to those skilled in the art. Thus, the present invention is not intended to be limited to the embodiments shown, but is to be accorded the widest scope consistent with the principles and features described herein.

FIG. 1 is a diagram illustrating a server system architecture incorporating a bi-directional docking mechanism in accordance with a preferred embodiment of the present invention. All the components of the system 10 are enclosed by a main chassis, which is not shown for purposes of illustration. The components of the system 10 include I/O and system management cards 12, PCI adapter cards to 14, media cards 16, a component board 18, such as a main central processor

board 20, hard disk storage devices 22, a power subsystem 24, and a thermal subsystem 26.

The component board 18 is mounted vertically in the chassis in a front-to-rear orientation. A single main central processor board, hereinafter referred to as a central electronics console (CEC) 20, is located on one side of the component board 18. With respect to the chassis, the CEC 20 lies on the same horizontal plane as the component board 18, and lies parallel to the component board 18 along a direction of insertion (front-to-back). In the preferred embodiment, the direction of insertion is along a longitudinal axis of the CEC 20 and the chamber in the chassis in which it is inserted and housed.

In order to keep the depth of the chassis and short as possible, space in the chassis above the CEC 20 is efficiently utilized by the power subsystem 24 and the CEC thermal subsystem 26. Fans within thermal subsystem 26 draw air through the CEC 20 for cooling.

FIGS. 2 and 3A-3B are diagrams illustrating the CEC in further detail. The CEC 20 is supported by a base plate 34 on which high-density connectors 30, processor 36, and memory 38 are mounted. An airtight cover 40 covers the processors 36, but not the memory 38. The fan in the thermal subsystem 26 creates a negative pressure drop, creating an airflow from the air intake 42 in the

front of the CEC 20 to the air exhaust 44 over the memory 38. FIGS. 3A-3B show the CEC 20 with the cover 40 removed.

In a preferred embodiment, the CEC 20 is installed through an opening in the front of the chassis under the power subsystem 24. FIG. 4 is a diagram showing a cut-away view of the CEC 20 docked with the component board 18. Once the CEC 20 is installed in the chassis, docking connectors 30, which are located on the side of the CEC 20 adjacent to the component board 18, engage with connectors 32 on the component board 18. Although the CEC 20 lies in the same horizontal plane in the chassis as the component board 18, the CEC 20 must be mated with the component board at an angle orthogonal to the direction of installation of the CEC 20.

The present invention provides a bi-directional docking mechanism that enables the CEC 20 to be installed from the front/rear of the chassis, and subsequently moved laterally to dock with the component board 18. The docking mechanism provides both required dual motions, and precisely orients the CEC docking connectors 30 with the connectors 32 on the component board 18 to allow blind docking between the CEC 20 and the component board 18.

According to the present invention, the first docking motion occurs during installation in which an operator inserts the CEC 20 into an opening in the front of the chassis and slides the CEC 20 from front-to-rear. When the back of CEC 20

reaches the rear the chassis, the CEC 20 is positioned such that the CEC connectors 32 align with, and are in close proximity to, the component board connectors 32.

After the installation motion, a second docking motion laterally moves the CEC along the horizontal plane of the chassis towards the component board 18, such that the CEC connectors 30 engage the component board connectors 32, thereby enabling blind docking between the CEC 20 and the component board 18.

FIGS. 5A and 5B are diagrams illustrating components of the dual motion docking mechanism that enable the first docking motion. In FIG. 5A, the CEC 20 is shown with the electronics and cover removed showing the top of the base plate 34. In one preferred embodiment of the present invention, the first docking motion is partially implemented by attaching a component board docking base 50 to the bottom of the component board 18 and to the rear of the chassis.

FIGS. 7A and 7B are views in which the docking base 50 can be seen attached to the bottom of the component board 18. The component board 18 can be inserted and removed from the chassis from the rear. In a preferred embodiment, the component board 18 has an interlocking spring pin (not shown) that locks the component board 18 into position on the docking base 50 as the

component board is pushed into the chassis from the back and reaches its front-most position.

Referring again to FIG. 5A, the docking base 50 is preferably rectangular with a length generally matching that of the component board 18. The docking base 50 includes a longitudinal female track 52 extending along an outer edge, away from the component board 18, and multiple positional orientation keys 54 longitudinally aligned along the edge closest to the component board 18.

FIG. 5B is a diagram showing a side and front view of the base plate 34. Beneath the base plate 34 is attached a sliding plate 74 (see also FIGS. 9-11). The sliding plate 74 includes a longitudinal male rail 56 on the bottom thereof located along a side of the CEC 20 adjacent to the component board 18. The rail 56 fits within track 52 on the docking base 50. As shown in both FIGS. 5A and 5B, the base plate 34 further includes multiple positional orientation keys slots that mate with the orientation keys 54 of the docking base 50.

When the CEC 20 is presented into the chassis opening during installation, the rail 56 engages the track 52 on the docking base 50, allowing the CEC 20 to be slid into the chassis over the docking base 50. As the CEC 20 is slid to the rear of the chassis, the CEC 20 is guided by the docking base track 52. When the CEC 20 reaches its resting position, all of the keys 54 align with the respective keys slots 58.

FIG. 6 is a diagram illustrating the base plate 34 and the docking base 50 when the CEC 20 is in the docked position. During the second docking motion, the CEC 20 is moved laterally towards the component board 18, the implementation of which is described below. According to the present invention, the orientation keys slots 58 on the base plate 34 mate with the orientation keys 54 of the base plate 50 to ensure that CEC connectors 30 correctly align with the component board connectors 32 when the CEC 20 is in the final docked position. The orientation keys 54 and keys slots 58 are staggered in distance and aligned with one another in a manner that prevents the docking of the CEC 20 with the component board 18 in all, but the final correct position.

FIGS. 8-11 are diagrams illustrating components of the dual motion docking mechanism that enable the second docking motion. In a preferred embodiment, the components necessary for the second docking motion include an actuator handle 70 and a cam mechanism 72. According to the present invention, the CEC 20 is installed into the chassis with the actuator handle 70 extended from the front of the CEC 20. Once the CEC 20 slid fully to the rear, the actuator handle 70 is pushed rearward by hand, which actuates the cam mechanism 72. The cam mechanism 72, a portion of which is held immobile by the base plate 50, then pulls the CEC 20 towards the docking base until the CEC connectors 30 mate with the component board connectors 32.

Figure 9 is an exploded view of a preferred embodiment of the cam mechanism 72. In the cam mechanism 72, the sliding plate 74 is mounted under the base plate 34. The activation handle 70 is slidably mounted beneath the sliding plate 74 for front-to-back motion (and vice versa). Both the sliding plate 74 and the actuation handle 70 include multiple cam tracks 76 (preferably three). The cam tracks 76 on the sliding plate 74 are positioned perpendicular to the longitudinal axis of the CEC 20, while the cam tracks 76 on the actuation handle 70 are positioned parallel to the longitudinal axis of the CEC 20. Multiple cams 78 (preferably three) are mounted to the base plate 34. The respective cam tracks 76 of the sliding plate 74 and the actuation handle 70 are vertically aligned such that one cam 78 extends through one pair of aligned cam tracks 76.

As shown in FIGS. 5B and 11, the sliding plate 74 allows the CEC 20 to be slid into the stationery docking base 50. Once mated to the docking base 50, the sliding plate 74 is fixed in place. However, the base plate 34 of the CEC 20 is free to move horizontally with respect to sliding plate 74 due to the cam mechanism 72. When the actuation handle 70 is pushed in, the cams 78 slide in the cam tracks 76 and pull the CEC 20 toward over the fixed sliding plate 74 and towards the component board 18 to engage the connectors 30 and 32.

Figure 10 shows a bottom view of the CEC 20 in an undocked position with the actuation handle 70 extended. FIG. 11 shows a bottom view of the CEC

20 in the docked position with the actuation handle 70 pushed-in and an access cover 80 of the CEC 20 closed.

To undock the CEC 20, the front access cover 80 is opened and the actuator handle 70 is pulled out from the front of the CEC 20. This results in the CEC 20 moving laterally away from the component board 18 to disengage the connectors 30 and 32. The orientation keys slots 58 are also pulled away from the orientation keys 54 (FIGS. 5A and 6). An operator is then free to pull the CEC 20 out of the chassis along the rail 56 and track 52 of the sliding plate 74 and docking base 50, respectively.

As processor cards, such as the CEC 20, become larger and include more components, the mass of the CEC 20 may cause the CEC 20 to shake during operation of the server. Overtime, the shaking may cause pins within the connectors 30 and 32 to break.

According to a further aspect of the present invention, the dual motion docking mechanism also reduces vibrations experienced by the CEC 20. As shown in FIGS. 4, 8, 9, and 11, the sliding plate 74 is provided with two retractable lateral support members 82. The side of the CEC 20 opposite that of the component board 18 includes two horizontal openings 84 for the retractable lateral support members 82. FIGS. 8 and 10 shows the CEC 20 in the undocked position in which the lateral support members 82 are retracted and flush with the

side of the CEC 20. Referring to FIGS. 4 and 11, as the actuation handle 70 is pushed in, and the CEC 20 moves towards the component board 18, the lateral support members 82 are exposed through the slits 84. The extended lateral support members 82 are restrain the CEC both vertical and horizontally.

The present invention has been described in accordance with the embodiments shown, and one of ordinary skill in the art will readily recognize that there could be variations to the embodiments, and any variations would be within the spirit and scope of the present invention. Accordingly, many modifications may be made by one of ordinary skill in the art without departing from the spirit and scope of the appended claims.